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SPECIFICATION

Formable Illumination Module

This invention relates to a formable illumination module with a plurality of circuit boards, on each of which there is at least one optical emitter, and that are wired into a chain by electrical power supply wires. It refers in particular to illumination modules for backlighting optically transparent materials such as acrylic, for example, in luminous letters.

Known illumination modules of this kind, for example such as the Tetra® LED system from GELCore or the LED tube from Hansen-neon permit no changes of the distances from LED structural element to LED structural element and are therefore not scalable with respect to luminance, and depending on the nature of emission, can be used only for a very limited size range of luminous letters with regard to luminance being as homogeneous as possible. Moreover, the maximum length of these illuminating modules is very limited.

The task underlying this invention is to make available an illumination module of the kind described initially in which the LED can be easily varied and with which longer chains are possible than in the past.

This task is accomplished by an illumination module with the features of Claim 1. Advantageous refinements of the illumination module are described in the subclaims.

There are a plurality of circuit boards in an illumination module according to the invention, on each of which there is at least one optical emitter, in particular an LED structural element, and which are wired into a chain by two massive electrical power supply wires. The electrical power supply wires run without interruption across all of the circuit boards of the chain. The circuit boards of the chain are connected to one another in parallel by means of these power supply wires.

The term "without interruption" means all embodiments in which the power supply wires are actually severed at the circuit board but are electrically connected to the circuit board without substantial reduction of the cross section.

In addition to the at least one optical emitter on each circuit board, there can also be at least one other electronic component that is electrically wired to the optical emitter.

In a preferred embodiment, the electrical power supply wires are joined in pairs into a bundle, for example crimped, between each two circuit boards to stiffen the connection between them.

In a special embodiment, the circuit boards are grouped into a plurality of pairs of circuit boards, and the optical emitters of each pair of circuit boards are wired between the two circuit boards by means of a connecting wire.

It is especially preferred for the optical emitters to be LED structural members.

The power supply wires preferably run between each pair of circuit boards over a meandering path. On the one hand, this allows for variation of the distance between two circuit boards, and on the other hand the bending radius of the chain can be modified easily.

It is especially preferred for the circuit boards to he tapered toward their ends facing one another, and for the power supply wires starting from a widened central section to merge along the edges of the circuit boards. To this end, the circuit boards are preferably made in rhomboidal shape or as flattened hexagons or octagons, in which the long axes are along the principal direction of the chain.

Either printed circuit boards (PCBs) or metal-wired circuit frames (leadframes) can be used as circuit boards, on which the optical emitters and any associated electronic structural elements are placed. It is also possible to make the circuit boards by MID technology, which includes hot-stamping, for example.

A particular benefit of the illuminating module pursuant to the invention consists of the fact that it can be adapted easily to specific customer needs without changing production. The meandering form of the power supply cable bundle between the circuit boards permits wide-ranging variations of the distance between the circuit boards and thus of the length of one and the same illuminating module.

An illuminating module pursuant to the invention can advantageously be manufactured simply by a reel-to-reel method in which power supply lines in "endless" form are stripped of their insulation at definite intervals and the circuit boards at these points are connected to the otherwise continuous power supply lines and joined with them.

Other benefits, refinements, and advantageous embodiments are found in the following example of embodiment explained in combination with the illustration.

The figure shows a schematic representation of a top view of the example of embodiment.

The figure is basically not to be viewed as drawn to scale. The individual components are basically also not shown in the actual ratios of relative sizes.

The example of embodiment has a plurality of circuit boards 1, on each of which are placed two LED structural elements 2, and that are wired into a chain by two electrical power supply wires 3, 4. The electrical power supply wires 3, 4 are fed over all of the circuit boards 1 of the chain without interruption, and wire the circuit boards 1 of the chain together in parallel.

Besides the LED structural elements 2, other electronic components 5 are placed on each circuit board 1 and are wired electrically to the LED structural elements 2.

To stiffen the connection between each pair of circuit boards 1, the electrical power supply wires 3, 4 are crimped into a bundle between them. Alternatively, a flat belt cable can be used that is split apart in the area of the circuit boards.

In a form of embodiment in which the LED structural elements of each adjacent pair of circuit boards are wired to one another, this is done by means of another connecting wire between the two circuit boards.

The power supply wires 3, 4 run in meandering fashion between each pair of circuit boards 1.

The circuit boards 1 have the form of an octagon stretched along the direction of extension of the chain, and the power supply wires 3, 4 starting from the widened central section merge along the edge of the circuit boards. In particular, they have no back face contacts, so that no particular precautions have to be taken when assembling the illumination module, for example to avoid a short circuit.

The circuit boards, for example, have a flat back face, so that it is possible, for example, to fasten them by means of a screw through a hole provided for the purpose, or by means of double-sided adhesive tape.

The illumination module can be manufactured simply by a reel-to-reel method in which power supply lines in "endless" form are stripped of their insulation at definite intervals and the circuit boards 1 at these points are connected to the otherwise continuous power supply lines, and joined to them.

The description of the invention with reference to the example of embodiment is of course not to be understood as a limitation of the invention to this example of embodiment. The features of the invention disclosed in the description above, in the drawing, and in the claims can be essential both individually and in any combination for the realization of the invention.

Patent Claims

1. Formable illumination module with a plurality of circuit boards, on each of which there is at least one optical emitter, and that are wired into a chain by electrical power supply wires, characterized by the fact that
the electrical power supply wires run across all of the circuit boards without interruption and the circuit boards of the chain are wired to one another in parallel.

2. Illumination module pursuant to Claim 1, in which in addition to the at least one optical emitter, at least one other additional electronic component is placed on a circuit board and is wired electrically to the optical emitter.

3. Illumination module pursuant to Claim 1 or 2, in which the electrical power supply wires are combined into a bundle between each pair of circuit boards to stiffen the connection.

4. Illumination module pursuant to at least one of the claims 1 to 3, in which the circuit boards are grouped into a plurality of pairs of circuit boards, and the optical emitters of each pair of circuit boards are wired together by means of a connecting wire between the two circuit boards.

5. Illumination module pursuant to at least one of the claims 1 to 4, in which the optical emitters are LED structural elements.

6. Illumination module pursuant to at least one of the claims 1 to 5, in which the power supply wires run in meandering fashion between each pair of circuit boards.

7. Illumination module pursuant to at least one of the claims 1 to 6, in which the circuit boards are tapered toward their ends facing one another, and the power supply wires starting from a widened central section merge along the edge of the circuit boards.

8. Illumination module pursuant to Claim 7, in which the circuit boards are rhomboidal in shape or have the form of a flattened hexagon or octagon, in which the long axes are along the principal direction of extension of the chain.

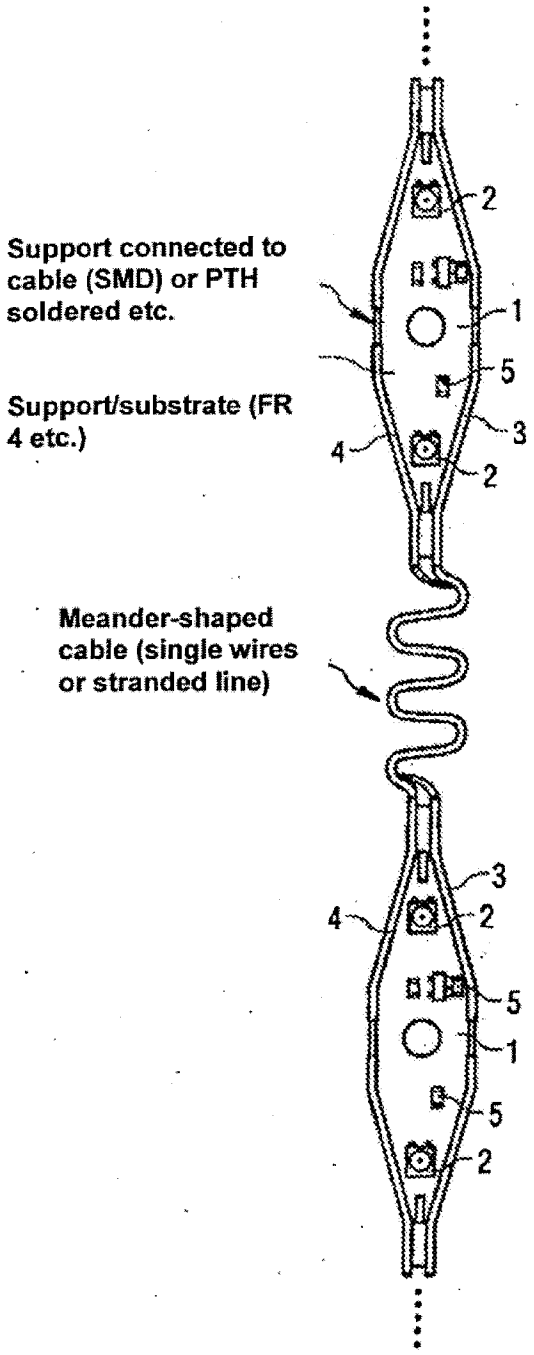
9. Illumination module pursuant to at least one of the claims 1 to 8, in which both the bending radius between any two circuit boards and the distance between the two circuit boards can be varied.

Abstract

Formable Illumination Module

Formable illumination module with a plurality of circuit boards, on each of which there is at least one optical emitter, and that are wired into a chain by electrical power supply wires. The electrical power supply wires run across all of the circuit boards of the chain without interruption and wire the circuit boards of the chain to one another in parallel.

Figure


Support connected to cable (SMD) or PTH soldered etc.
Support/substrate (FR 4 etc.)
Meander-shaped cable (single wires or stranded line)
1
2
3
4
5

Figure